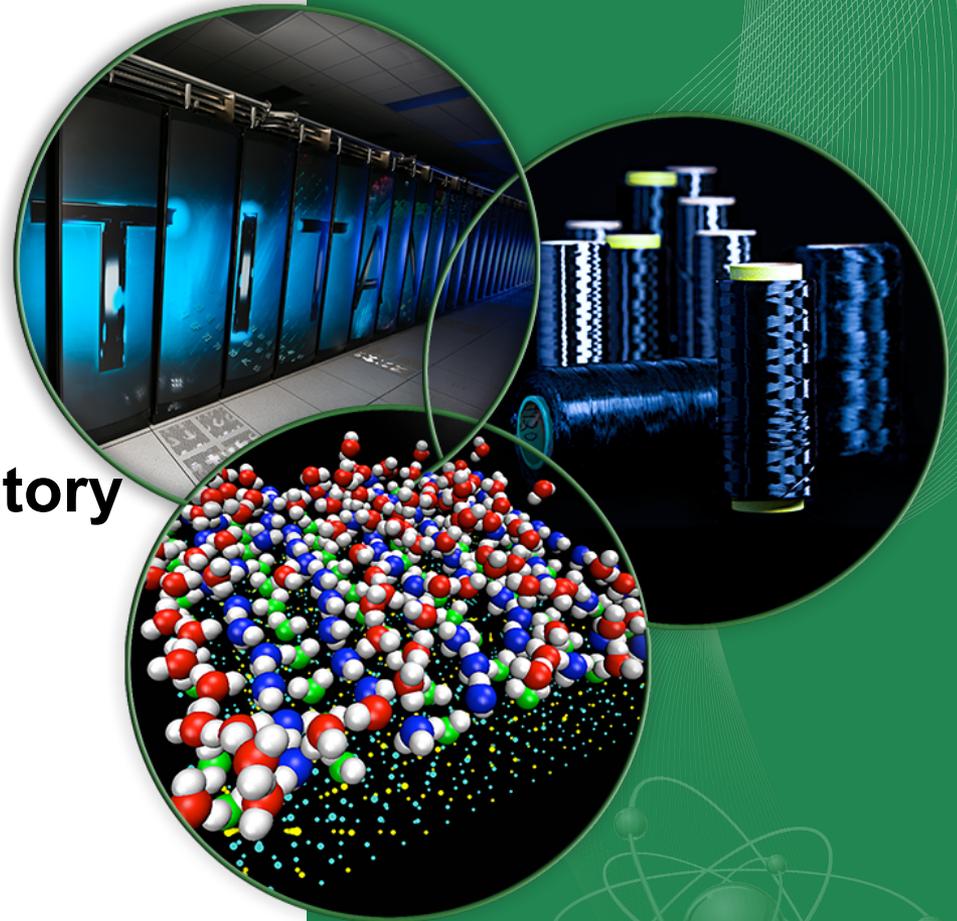


ORNL Neutron Cross-Section Measurements Activities

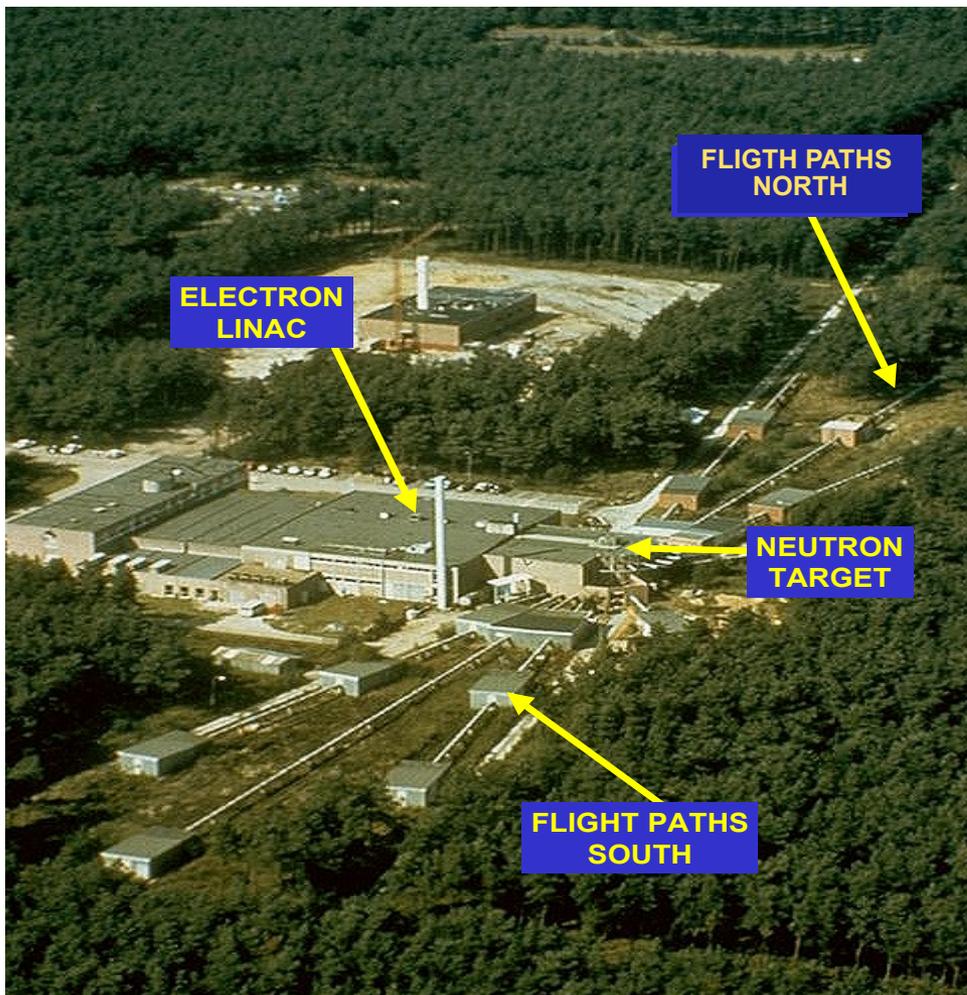
K. H. Guber

Oak Ridge National Laboratory

Oak Ridge, TN, USA



CSEWG Meeting 2015



GELINA



- Time-of-flight facility
- Pulsed white neutron source
($10 \text{ meV} < E_n < 20 \text{ MeV}$)
- Multi-user facility with 10 flight paths (10 m - 400 m)
- The measurement stations have special equipment to perform:
 - Total cross section measurements
 - Partial cross section measurements

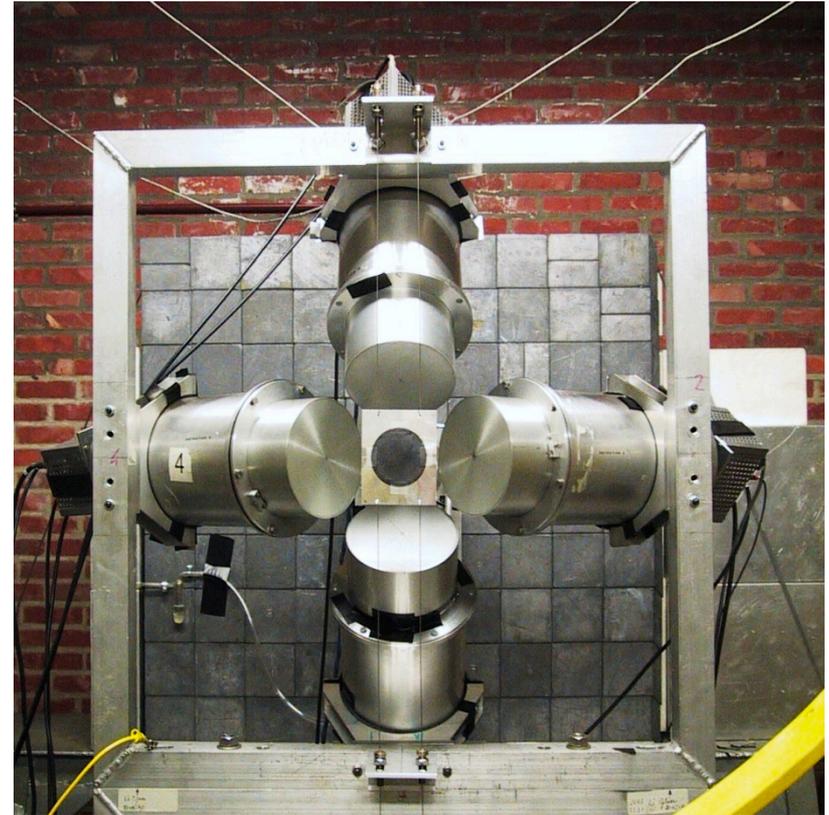
Pulse Width : 1ns
 Frequency : 40 Hz – 800 Hz
 Average Current : $4.7 \mu\text{A} - 75 \mu\text{A}$
 Neutron intensity : $1.6 \cdot 10^{12} - 2.5 \cdot 10^{13} \text{ n/s}$

Capture Cross-Section Measurements at GELINA

L = 10 m, 30 m and 60 m

Total energy detection

- C_6D_6 liquid scintillators
 - 125°
 - PHWT
- Flux measurements (IC)
 - $^{10}B(n,\alpha)$
 - $^{235}U(n,f)$

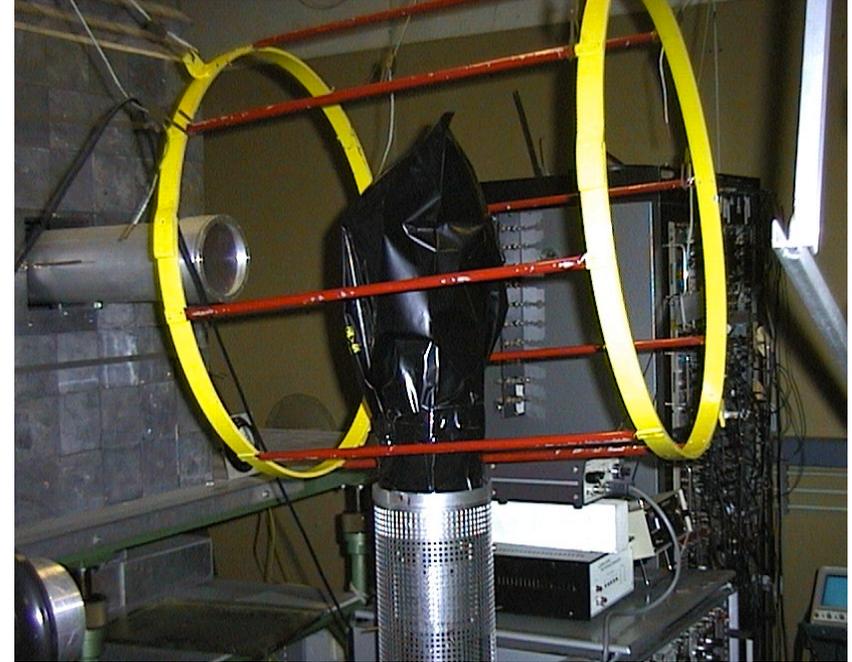


$$Y_{\text{exp}} = N\sigma_{\varphi} \frac{C_w - B_w}{C_{\varphi} - B_{\varphi}}$$

Transmission Measurements

Sample & Background Filters

Detector



Detector stations

Moderated: L= 30 m, 50 m, (100 m, 200 m)

Fast: L= 400 m

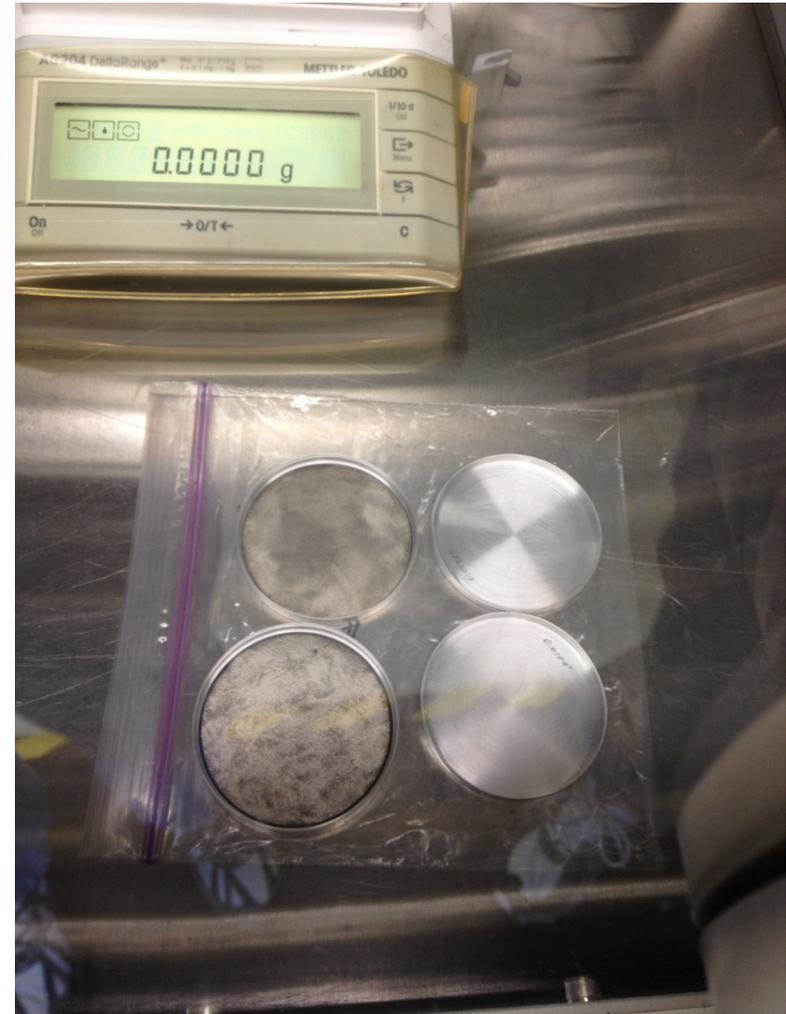
Low energy : ${}^6\text{Li}(n,t)\alpha$ Li-glass

High energy : H(n,n)H Plastic scintillator

$$T = \frac{C_{in}}{C_{out}} \cong e^{-n\sigma_{tot}}$$

ORNL Measurement Activities for Cerium

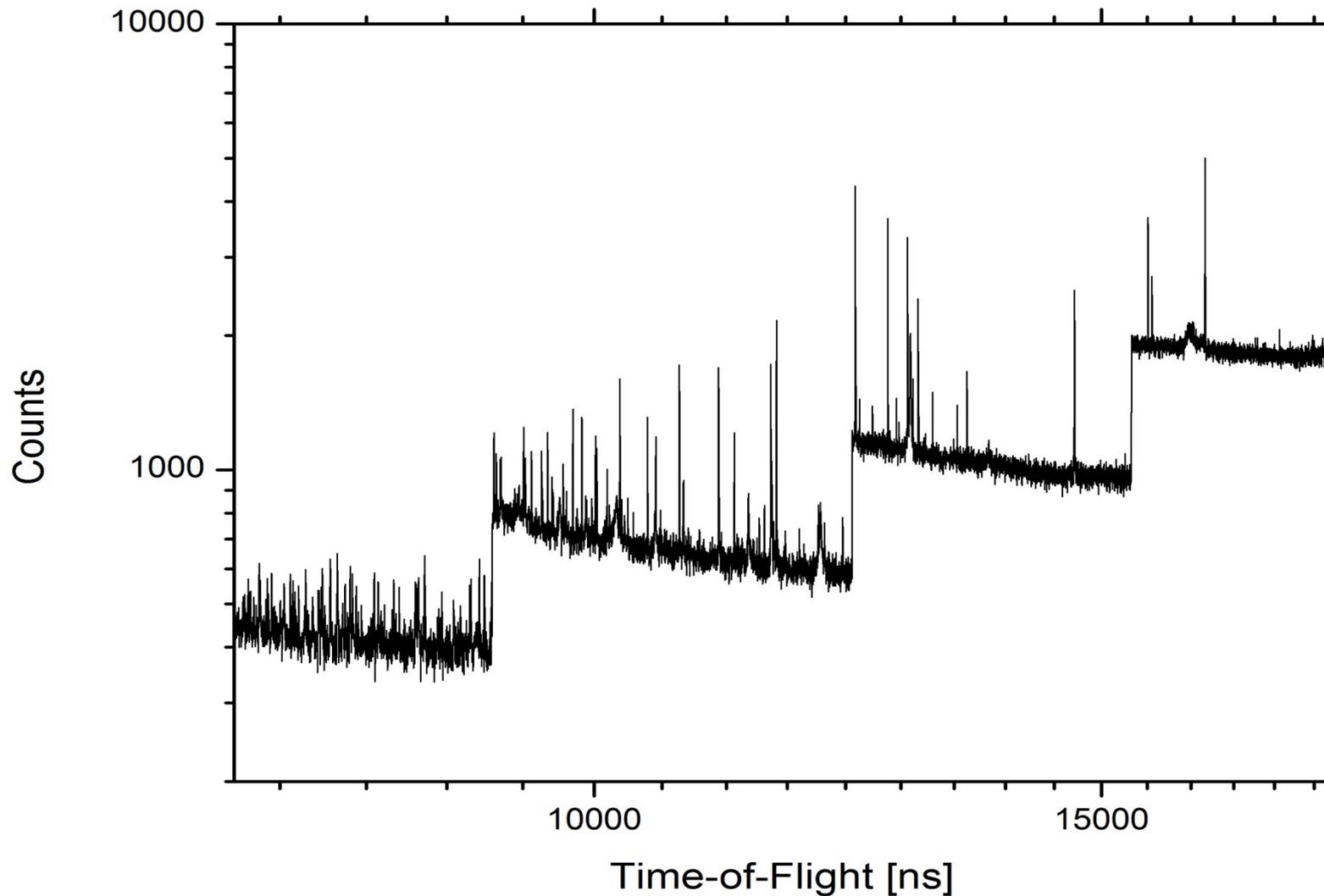
- **Measurements of Ce using natural metallic samples.**
- **The samples are in Al canning due to reactivity with air.**
- **Old experiments used CeCO_3 samples.**
 - For each Ce atom there are 4 atoms which only scatter neutrons due to their small capture cross section.
 - Produce unwanted prompt neutron background in capture experiment, within the width of the resonance.



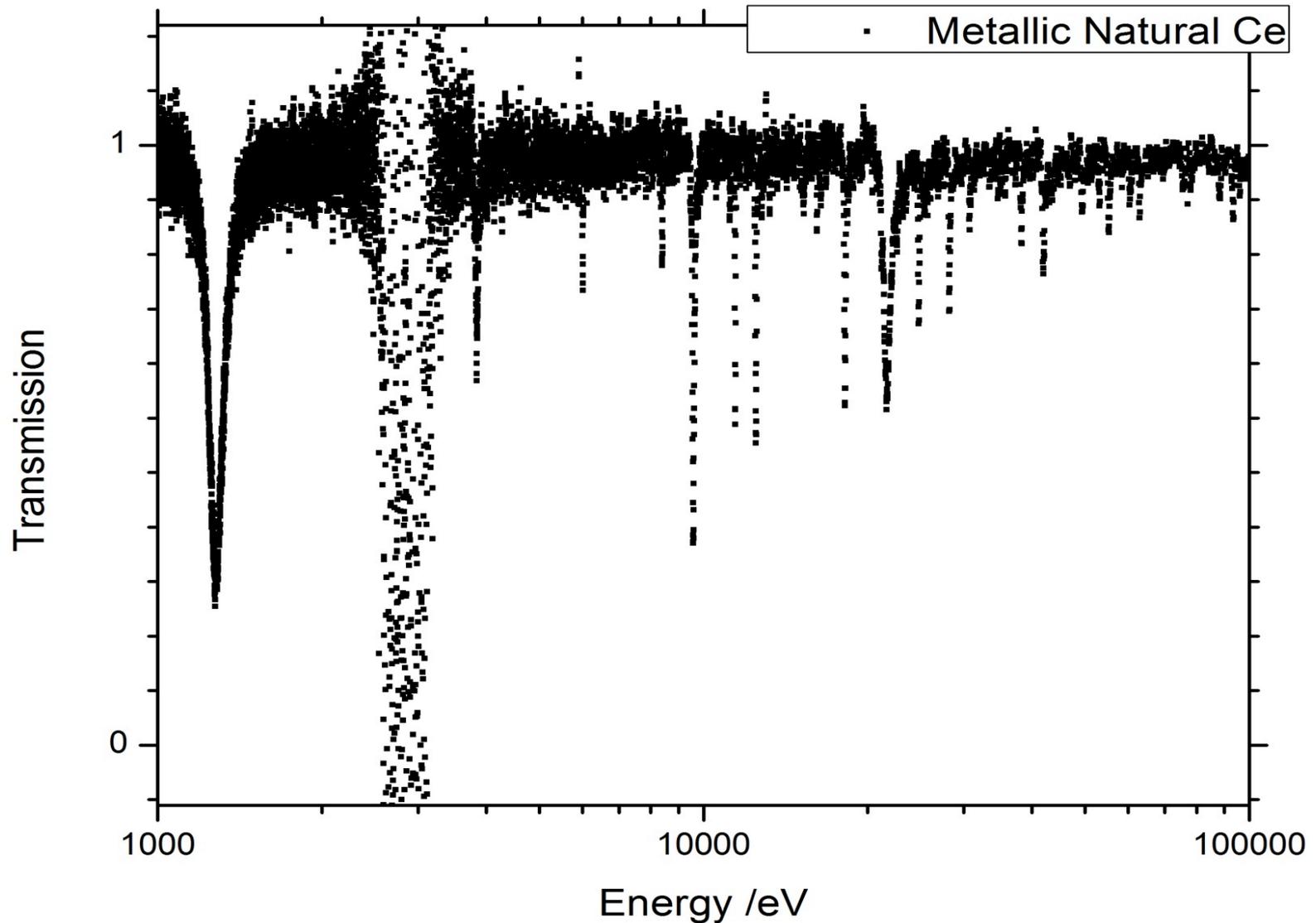
ORNL Measurement Activities for Cerium

- **Transmission experiments with different sample thickness were performed using FP4 50 m station.**
- **Neutron capture using detector system at FP14, 60 m.**
- **Experiments performed with different background filter combinations.**
- **Transmission and capture experiments using enriched Ce142 oxide sample are planned. Waiting on DOE decision for new lease policy.**

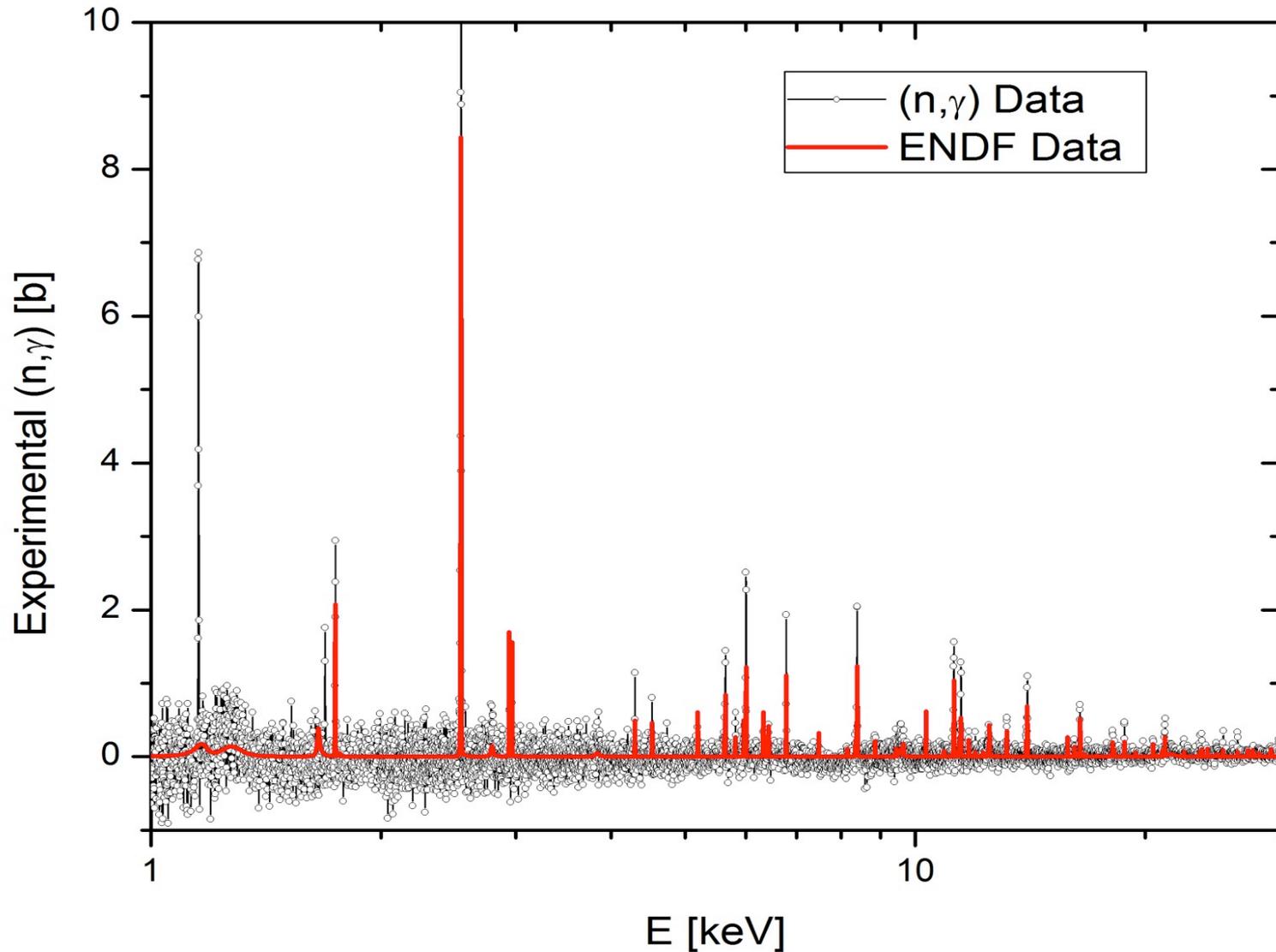
Natural Ce (n, γ) Raw Data Resolving Resonances above 200 keV



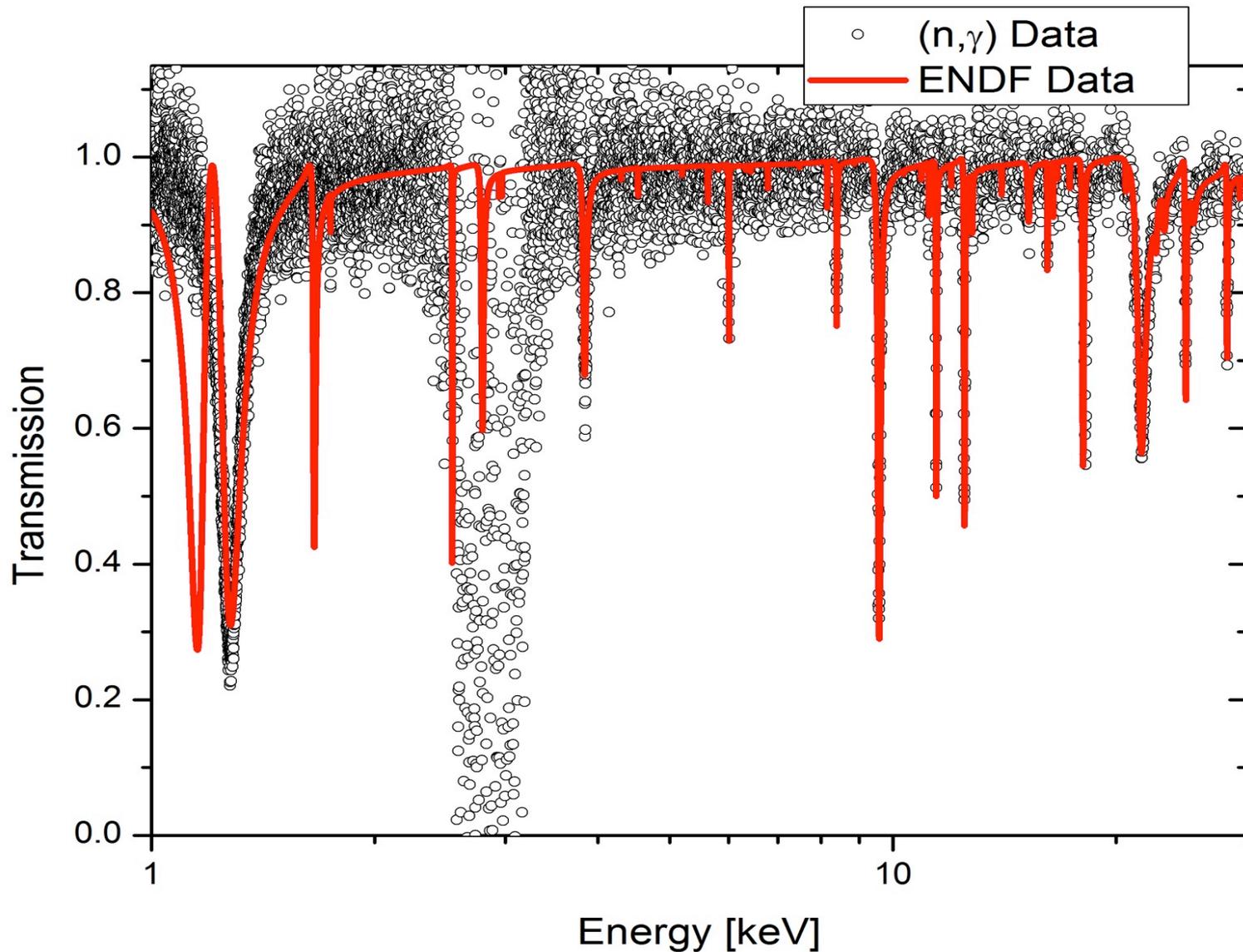
Transmission of Thin Natural Ce Sample



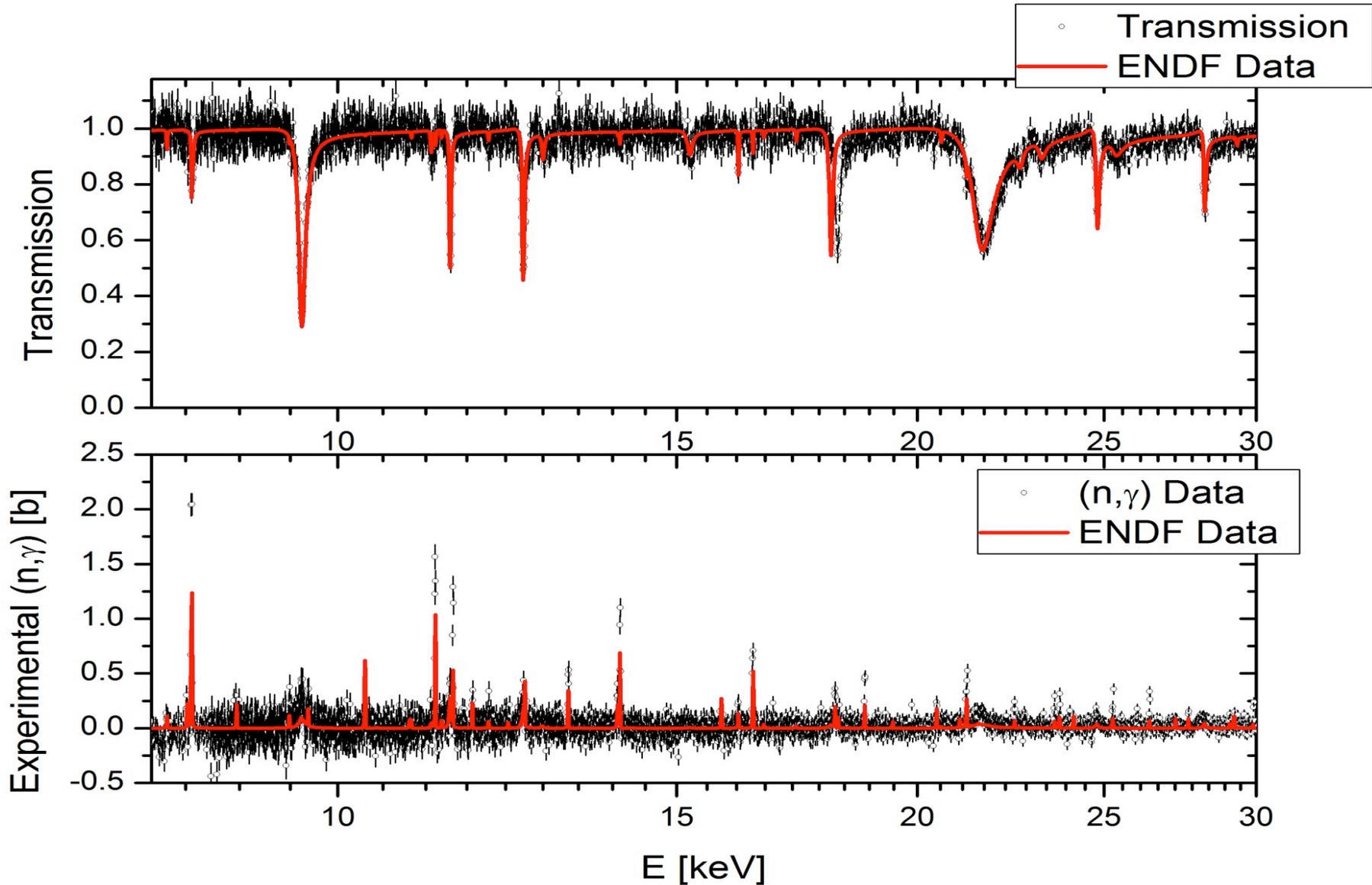
Ce (n, γ) Data compared to ENDF/B-VII.1



Ce Transmission Data compared to ENDF/B-VII.1



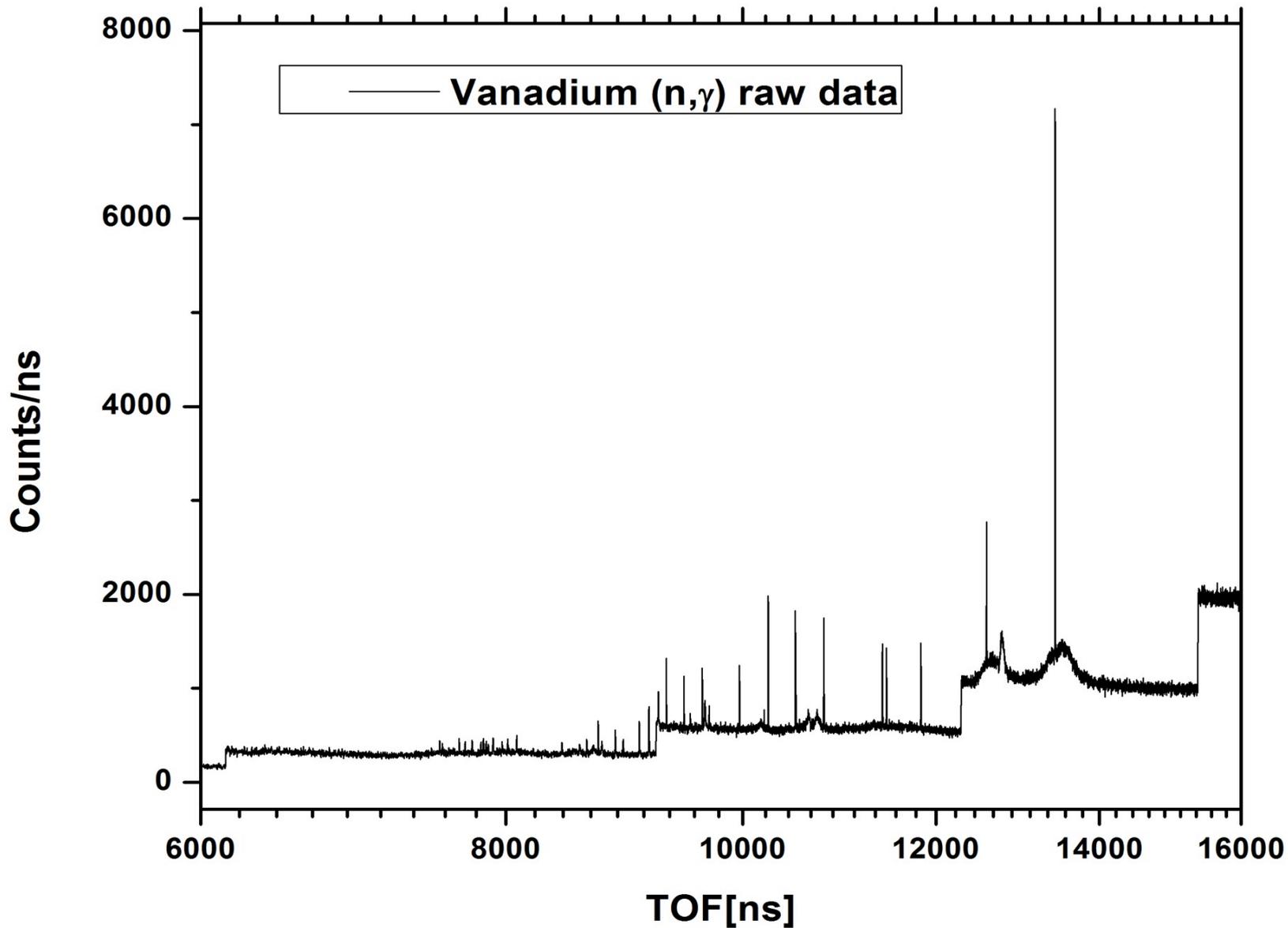
Ce Transmission and (n,γ) Data compared to ENDF/B-VII.1



ORNL Measurement Activities for Vanadium

- **V is mono-isotopic, non reactive in air.**
- **Measurements using metallic samples of different thickness**
- **Transmission experiments with different samples are performed using FP4, 50 m station**
- **Neutron capture using detector system at FP14, 60 m.**
- **Experiments performed with different background filter combinations.**
- **Capture and transmission experiments performed in FY15.**

V (n, γ) Raw Data for Thin Sample



Status of Experiments at GELINA

	Ca	Ce	V
Sample	metallic disks nat Ca	Metallic disks Nat Ce, Ce-142	metallic disks mono isotopic
Experiments GELINA	60m (n, γ) transmission	Nat Ce 60m (n, γ) Nat Ce transmission	60m (n, γ) transmission
Data Sorting	finished 60m Transmission	In progress Data for 2mm sample	
Reduced to Cross section	X-section transmission	2mm X-section 2mm transmission	
Data Testing	Data ready for evaluation	In progress	
Analysis and Evaluation	Started		

People Involved in the Experiments

- **Peter Schillebeeckx, IRMM**
- **Stefan Kopecky, IRMM**
- **Peter Siegler, IRMM**
- **Carlos Paradela, IRMM**
- **Ruud Wynats, IRMM**
- **Clint Ausmus, ORNL**